

*The University of the Witwatersrand
in association with North West University Present*

SHORT COURSES FOR INDUSTRY

in the series

LEADERSHIP IN COAL AND FUEL TECHNOLOGY

COAL SCHOOL 1

COAL SAMPLING AND ANALYSES FOR TRADE AND UTILISATION

15 - 19 February 2010

COURSE 1 – COAL SAMPLING – DAY 1

Methods, Applications and Limitations of Sampling in Industry

Date: 15 February 2010, 09:00 – 17:00

COURSE 2 – CONVENTIONAL ANALYSES FOR COAL – DAY 2

Conventional Analyses and Specifications

Date: 16 February 2010, 09:00 – 17:00

COURSE 3 – ADVANCED ANALYSES FOR COAL – DAY 3

Specialised analyses including Coal, Coke and Char Petrography; Mineralogy and Trace Elements

Date: 17 February 2010, 09:00 – 17:00

COURSE 4 – ADVANCED COMBUSTION TESTS – DAY 4

Combustion Tests, Standards and their applications in industry

Date: 18 February 2010, 09:00 – 17:00

COURSE 5 – COAL USER REQUIREMENTS – DAY 5

Contracts, Specifications, Classifications and Market Requirements

Date: 19 February 2010, 09:00 – 17:00

VENUE:

STURROCK PARK, Sports Administration, University of the Witwatersrand

OBJECTIVES OF THE COAL SCHOOL AND ITS DAILY COURSES

The primary objectives of these courses are

- **To provide a sound basis for coal sampling** in a variety of industrial situations
- **To introduce both conventional and advance analytical techniques** for the assessment of coal
- **To indicate how conventional and advanced analytical techniques may be applied** with specific reference to production, marketing and utilisation
- **To ensure maximum process efficiency and environmental protection** through an understanding of coal products and their performance characteristics
- **To ensure optimum utilisation** of South Africa's remaining coal reserves

BACKGROUND

Prior to 1975, coal mining and marketing practices were uncomplicated, being largely influenced by the abundance of good quality raw coals. In many cases, the best parts of seams were mined out to meet market specifications and requirements.

Since then, the export of high-value blend-coking coals and High Grade Steam coal to world markets has resulted in **local consumers now being obliged to use lower-grade higher-ash products**, either in the form of middlings arising from beneficiation or lower quality run-of-mine seams.

This **practice has become all the more challenging** in recent years because of the decreasing quality of the coal reserves now being encountered in the region and, in parallel, the increasing environmental constraints being imposed on users of coal.

These **factors have led to greater difficulties** being experienced by local users of coal, i.e. when coals of a different type and grade to that which the boiler or gasifier plant was originally designed are introduced into the process; under these conditions poor combustion or gasification performance often results.

In addition, it has now been recognized that

- (a) **SAMPLING** has become an issue of importance and must be conducted according to standards in order to represent bulk materials under review
- (b) **CONVENTIONAL COAL QUALITY ANALYSES** often provide insufficient information with respect to the potential performance required by consumers thus leading to the need for **ADVANCED ANALYSES AND TESTS**, and
- (c) **COAL QUALITY RELATIVE TO PLANT DESIGN AND OPERATION** is now a vital issue in order to ensure optimum process efficiency and maximum environmental control

In response to this scenario, sampling has reached a high level of application and new methods of quality assessment have evolved, along with adaptations in the design and operation of user technologies. For these reasons, it has now become necessary for all involved in the coal chain to understand the basic nature of the material and to how to sample and assess it to best advantage for all concerned.

This five-day coal school, separated into five one-day courses, is one in a series of schools designed for personnel in industry in the programme **Leadership in Coal and Energy Technology**.

MODUS OPERANDI OF THE COURSES

The courses will be presented in the following manner: Lecturers will introduce the **basic principles** (definitions) of the various topics, followed by **practice** (with some case histories) and, where appropriate, **predictive techniques** (indicating how to undertake value-added assessments). Open discussion and questions are encouraged at all times.

Whilst some course notes will be provided in the form of publications, presentations and various handout materials, the preferred course of action is for candidates to become aware through listening, understanding, discussing, questioning and where necessary taking own notes.

WHO SHOULD ATTEND THIS SCHOOL

- Coal quality analysts
- Exploration geologists and resource managers
- Mining engineers
- Coal processing engineers
- Marketing managers and those trading in coal
- Power generation and gasification engineers,
- Industrial combustion users of coal including those co-firing coal and biomass
- Engineering manufacturers
- Environmental scientists and engineers
- Consultants, fuel technologists, researchers in academia and
- Government personnel responsible for future coal reserves/ resources and related legislation.

COURSE PROGRAMME

COURSE 1 - COAL SAMPLING

DAY 1: MONDAY 15 FEBRUARY 2010

OUTLINE OF DAY 1

Introduction to the principles and practice of coal sampling in coal exploitation, storage, handling, and utilisation. Methods of sampling. Sampling statistics, variance, calibration and application. Local and international sampling standards.

08:00-09:00 - Registration

09:00-09:05 - Introduction-

09:05-10:30 - Sampling and statistics – an introduction to the vagaries of sampling. Sampling methods used during mining, storage in stockpiles and bunkers or silos, on conveyors, on stationary belts and in falling stream mode. *Mr Alan Johns; AI Witlab*

10:30-11:00 Tea

11:00-13:00 – Sampling during transportation by truck, train and ship. Sampling calculations, variance and calibration. Bias testing of sampling plants. *Mr Alan Johns; AI Witlab*

13:00-14:00 Lunch

14:00-15:15 – SANS/ ISO Sampling standards and reporting mechanisms. *Mr Alan Johns, Witlab*

15:15-15:30 Tea

15:30-16:45 - Key issues for sampling and related analyses, new terminology and the impact on international trade. *Mr Alan Johns; AI Witlab*

COURSE 2 - CONVENTIONAL ANALYSES FOR COAL

DAY 2: TUESDAY 16 FEBRUARY 2010

OUTLINE OF DAY 2

Principles and practices of conventional analyses and tests used in coal production and marketing, the analytical bases to which they are reported, reporting mechanisms, methods of conversion, calculation and prediction. Beneficiation/washability tests, densimetric curves and yield predictions.

07:45-09:00 – Registration

09:00-09:05 - Introduction- *Prof R Falcon, convenor*

09:05-10:30 - Chemical and chemico-physical analyses including calorific value, proximate/ultimate analysis, ash composition, forms of sulphur, ash fusion temperatures. *Mr Alan Johns; AI Witlab*

10:30-11:00 Tea

11:00-12:00 – Physical properties of coal including relative density, Hardgrove Index, abrasion, porosity, free swelling index, coke strength and shatterability indices, plastometry, washability tests and indices. *Mr Alan Johns; AI Witlab*

12:00-13:00 – (Continued) Physical properties of coal including relative density, Hardgrove Index, abrasion, porosity, free swelling index, coke strength and shatterability indices, plastometry and dilatation. *Mr Alan Johns; AI Witlab*

13:00-13:30 Lunch

13:30-15:30 – Definition of coal quality reporting bases, methods of conversion, calculation and prediction. The impact of dilution, mixing and blending. *Mr Alan Johns; AI Witlab*

15:30-15:45 Tea

15:45– 17:00 - Coal beneficiation - washability tests and characteristics of coal, tests and the compilation and interpretation of washability tables. *Mr Lionel Falcon; Wits*

COURSE 3 - ADVANCED ANALYSES FOR COAL

DAY 3: WEDNESDAY 17 FEBRUARY 2010

OUTLINE OF DAY 3

Principles and practice of advanced analytical techniques for indepth assessment of coal qualities for specialised utilisation purposes; the use of forensic techniques to evaluate, diagnose and predict coal quality and performance in detail. Principles and practice of petrography and mineralogy. Laboratory scale tests to predict self-heating leading to spontaneous combustion and explosibility

08:00-08:30 - Registration

08:30-10:30 – Coal Petrography I - Organic and inorganic constituents in coal, rank determination, condition analyses (oxidised, weathered and heated-affected analyses); distribution of components in-seam, between seams and coalfields, during mining and beneficiation. *Prof R Falcon, Wits*

10:30-11:00 Tea

11:00-12:00 – Coal Petrography II - Coke-char forms; technical properties, potential performance and impacts on a variety of utilisation processes *Prof R Falcon, Wits*

12:00-13:00 – Coal Mineralogy I - Forms and distribution of trace elements, their properties and impacts on health and the environment. *Prof N Wagner, Wits*

13:00-14:00 Lunch

14:00-15:00 – Coal Mineralogy II - Iron in coal – assessment and impact on utilisation. *Prof F Waanders, NWU*

15:00-15:30 Tea

15:30-17:00 – Coal Mineralogy III – Minerals and post-utilisation ash composition. *Dr C van Alphen, Eskom*

COURSE 4 – ADVANCED COMBUSTION TESTS

DAY 4: THURSDAY 18 February 2010

Host: Energy Research and Innovation Centre, Eskom - *Prof M van der Riet/Mr P Rajoo*

OUTLINE OF DAY 4

PLANT VISIT - ESKOM TSI COMBUSTION TEST RIG AND DROP TUBE

Principles and practice of special pilot scale tests used in the evaluation of coal for specific coal combustion and gasification purposes.

08:00-09:00 - Registration

09:00-12:30 - Visit to pilot scale combustion test facility with lectures on combustion and gasification testing, modelling and monitoring.

09:30-10:15 – Lecture: Assessment of combustion potential for power generation.,

10:15-10:45 – Lecture: Clean Coal Technologies for power generation.

10:45-11:00 – Tea

11:00-11:30 – Tour of Drop Tube Furnace

11:30-12:30 – Tour of Pilot Scale Test Facilities – pulverized coal and fluidized bed.

12:30- 13:30 - *Lunch*

13:30-16:00 - Group discussions

COURSE 5 - COAL USER REQUIREMENTS

DAY 5: FRIDAY 19 February 2010

OUTLINE OF DAY 5

Specialised aspects and case histories in the predication of the coal performance relative to the requirements of users in the power generation, gasification, metallurgical and petrochemical industries in South Africa. Summary of the key coal properties required for each user process. Solving performance problems. Product specification. National and international standards for classification.

08:00-08:30 - Registration

08:30-09:30 – Marketing of coal in South Africa and the impact of coal quality on **industrial users**. *Prof R Falcon, Wits*

09:30-10:30 – Impact of coal quality on gasification and the **petrochemical industry**. *Dr E Koper, Sasol*

10:30-11:00 Tea

11:00-13:00 - Impact of coal quality on **power station** performance with application of on-line analysing systems with the pros, cons and applications. Key case histories. *Mr Mike Blenkinsop, Consultant*

13:00-13:30 Lunch

13:30-14:30 – Coal quality requirements for the **metallurgical industries**. *Prof R Pinheiro, Riversdale*

14:30-15:30 - Principles **of coal selection, acquisition and substitution**. Coal classification and Categorization of coal for marketing purposes. Latest ISO coal classification standards. *Prof R Pinheiro/Prof R Falcon Wits.*

15:30-15:45 Tea

15:45-17:30 - Final Group Discussion: Summary and closure.

COAL SAMPLING AND ANALYSIS FOR TRADE AND UTILISATION

REGISTRATION - FIVE-DAY ATTENDANCE:

R7 500 + VAT R1050 = R8550

Email registration to:

MRS L STEPHENSON. VAT No: **4270185251**

Tel: 011 447 1490 Cell: 083 679 0697

Email: **lstephenson@mweb.co.za**

NAME:..... **TITLE**.....

AFFILIATION

COMPANY.....

ADDRESS.....

TEL:..... **FAX**..... **MOBILE**.....

EMAIL:.....

ACCOUNTS CONTACT PERSON.....

ACCOUNTS TEL NUMBER.....

ACCOUNTS EMAIL ADDRESS.....

COMPANY VAT NO:

NB: ATTENDANCE IS STRICTLY SUBJECT TO PAYMENT PRIOR TO THE COURSE

BANKING DETAILS: *Please fax a copy of the deposit slip to EFT to (011) 447 6148 or email address above*
Fossil Fuel Foundation of Africa (Educational Courses)

Bank: ABSA

Branch Code: 632 005

Account No: 919 978 4837

Please use your invoice no. as a reference on deposit slip.

Ref: **1001CS** - Coal Sampling

CANCELLATION OF THIS REGISTRATION

Cancellation may be made in writing 7 days prior to this course, whereon a 25% cancellation fee will be charged. No refund or credit will be issued within the 7 days of the course. Registrations are transferable. Invoices will be sent once registration forms have been submitted. **KINDLY NOTE: ATTENDANCE IS STRICTLY SUBJECT TO PRIOR PAYMENT**

COAL SAMPLING AND QUALITY ASSESSMENT FOR TRADE AND UTILISATION

REGISTRATION - DAILY ATTENDANCE:

R1 650-00 Plus VAT R231 = R1881 per day

DAY 1..... DAY 2..... DAY 3..... DAY 4..... DAY 5.....

Email registration to:

MRS L STEPHENSON. VAT No: **4270185251**

Tel: 011 447 1490 Cell: 083 679 0697

Email: **lstephenson@mweb.co.za**

NAME:.....**TITLE**.....

AFFILIATION

COMPANY.....

ADDRESS.....

TEL:.....**FAX**.....**EMAIL:**.....

ACCOUNTS CONTACT PERSON.....

ACCOUNTS TEL NUMBER.....

ACCOUNTS EMAIL ADDRESS.....

FFF MEMBERSHIP ...Yes/No..... **Membership No**.....

COMPANY VAT NO:

NB: ATTENDANCE IS STRICTLY SUBJECT TO PAYMENT PRIOR TO THE COURSE

BANKING DETAILS: Please fax a copy of the deposit slip to EFT to (011) 447 6148 or email address above
Fossil Fuel Foundation of Africa (Educational Courses)

Bank: ABSA

Branch Code: 632 005

Account No: 919 978 4837 **Please use your invoice no. as a reference on your deposit slip.**

Ref: **1001CS** - Coal Sampling

CANCELLATION OF THIS REGISTRATION

Cancellation may be made in writing 7 days prior to this course, whereon a 25% cancellation fee will be charged. No refund or credit will be issued within the 7 days of the course. Registrations are transferable. Invoices will be sent once registration forms have been submitted. **KINDLY NOTE: ATTENDANCE IS STRICTLY SUBJECT TO PRIOR PAYMENT**

FORTHCOMING COAL SCHOOLS in 2010

Provisional Dates

1. **Economic Geology and Exploration of Coal:** 15-19 March
2. **Coal Preparation and Beneficiation:** 12-16 April
3. **Coal Mining, Extraction and Exploitation:** 17- 21 May
4. **Coal Combustion and Power Generation:** 26 – 30 July
4. **Coal & the Environment:** 6 – 10 September
5. **Coal Management and Marketing:** 8 – 12 November

For all enquiries contact:

DAILY AND WEEKLY ATTENDANCE:

Mrs Lesley Stephenson 011 447 1490 (lstephenson@mweb.co.za)

FORMAL ACADEMIC REQUIREMENTS

Mrs Maggie Blair 011 717 7387 or margaret.blair@wits.ac.za
Prof R Falcon (Rosemary.Falcon@wits.ac.za or falcons@icon.co.za)